To the Revd Mr Monteath
from the Author

AN INAUGURAL

8503 ee 6

ORATION,

ON THE

PROGRESS AND IMPORTANCE

OF THE

MATHEMATICAL SCIENCES.

Delivered at Princeton on the evening preceding the
Annual Commencement 1788,

BY

WALTER MINTO, L. L. D.

Profeſſor of Mathematics and Natural Philoſophy
in the College of New-Jerſey.

TRENTON:
PRINTED BY ISAAC COLLINS.
M.DCC.LXXXVIII.

BRITISH MUSEUM

AN INAUGURAL
ORATION,
ON THE
PROGRESS AND IMPORTANCE
OF THE
MATHEMATICAL SCIENCES.

I WILL not endeavour, as is often done in addreſſes of this kind, to prepoſſeſs my audience in favour of the ſpeaker, by pleading want of abilities to perform my taſk. Proteſtations of this nature are frequently inſincere, and generally meet with the reception they deſerve. Nor will I entertain you with eulogies on the Founders, the Truſtees, and the Faculty of the College—for their works praiſe them.

My intention is to make a few general remarks on the Origin, Progreſs and chief Promoters of the Mathematical Sciences, the ſubjects of my profeſſion, and on the Importance and Advantages of thoſe Sciences.

I MUST beg leave, however, to make one apology, which the audience I have the honor to addreſs, will not think either unreaſonable or improper. It is: that, being accuſtomed for ſeveral years to a ſtudy in which the feweſt and ſimpleſt terms are uſed, I cannot be ſuppoſed to poſſeſs the qualifications or to act the part of the orator. I hope, therefore, you will be pleaſed to diſpenſe with thoſe ornaments which uſually diſtinguiſh inaugural orations.

I REMARK, I. That the neceſſities of ſociety gave birth to the Arts and Sciences.

THE Author of Nature has wiſely ordained that man ſhould owe the preſervation of his life, and the enjoyment of happineſs, to his own activity and ingenuity. In the infancy of ſociety, the wants of the individual are few, and are procured without much exertion of the mind. The genius of Newton, had he been born among the Indians, inſtead of diſcovering the laws of the univerſe, would have been limited to the improvement of the inſtruments of hunting, or to the conſtruction of commodious wigwams. In proportion to the increaſe of population, thoſe means of ſubſiſtence which Nature throws in the way, diminiſh in number, and become more difficult to be obtained. After the reſources from the ſpontaneous productions of the earth, from game and from the taming of cattle, become too ſcanty for his ſubſiſtence, man is driven to the cultivation of the ſoil, and to the invention of inſtruments neceſſary for this purpoſe. As ſome are more induſtrious than others, and as every one has a right to the fruits of his own induſtry, ſociety, when arrived at the agricultural ſtate, makes a partition of their lands. In proceſs of time, the field of every family is diſtinguiſhed, where nature has not done it, by artificial marks. As theſe are liable to be ſwept away by inundations, or defaced by time, or to be moved by a covetous neighbour, it is found neceſſary to determine the boundaries of farms by menſuration.

Such muſt have been the origin of Geometry. *

This account is perfectly conſonant with hiſtory. Ariſtotle, Herodotus and Strabo concur in teſtifying that the Mathematics took their riſe in Egypt—a country ſubjected to an annual inundation. From Egypt they were tranſplanted into Greece, firſt by Thales the Mileſian, about five hundred and eighty-four years before the chriſtian æra, and afterwards by Pythagoras and Plato. The Grecian philoſophers, by abſtracting Geometry from Matter, and by inventing many new and uſeful theorems, greatly

---

* As to Arithmetic, which is ſo neceſſary to man that it muſt have made its appearance on the rudeſt ſtage of ſociety, the reader may conſult the *Account of the life, writings and inventions of John Napier of Merchiſton*, the joint work of the Right Honorable the Earl of Buchan and of the author, where the ſubject is treated at conſiderable length.

ly improved this ſcience, or rather created it, for it ſeems to have been only an art in the hands of their maſters. This leads me to obſerve,

II. That it is in civilized ſociety where the Arts and Sciences receive improvement and perfection.

In the ſavage ſtate, man has to wage continual war with the elements and with ferocious animals. He thinks of no other arts, therefore, but ſuch as are neceſſary for his defence, and for procuring him his precarious ſubſiſtence. It is not until ſociety has made conſiderable progreſs in civilization, that a part of the community obtains an exemption from labor, which is abſolutely neceſſary to the ſucceſsful cultivation of ſcience. When his neceſſities do not prompt him to bodily exertion, man is conſtrained to exert the powers of the mind. The principle of curioſity implanted in his breaſt, the encreaſing wants of ſociety, and the honors or rewards conferred on thoſe who ſupply them, give impulſe and direction to ingenuity, and are the fruitful ſource of all the improvements in the arts and ſciences, in civilization, and in human reaſon.

THIS alſo agrees with hiſtorical fact. The prieſts of Egypt, from their manner of life, and from the ſituation of that country, were led to the contemplation of ſpeculative truths, before any other body of men of whom we have an authentic account. It is well known in what a high degree of eſtimation the philoſophers of Greece were generally held by their countrymen: and the influence they had in promoting the civilization, happineſs and glory of that renowned part of the world, is univerſally acknowledged.

III. The progreſs of the human mind, from ignorance to knowledge, has generally been ſlow, and not by the moſt obvious and eaſy path.

It was almoſt three hundred years after the firſt introduction of Geometry into Greece, when the elements of that ſcience were firſt collected and methodized by Euclid. And there is a circumſtance related in hiſtory * which perhaps will ſurpriſe every young man newly entered on the ſtudy of the Mathematics. The circumſtance is this: one perſon found that the three angles of an equilateral plane triangle were equal to two right angles; another afterwards demonſtrated the ſame

---

* Maclaurin's account of Sir Iſaac Newton's diſcoveries.

ſame thing with regard to an iſoſceles triangle; and it was a third perſon who ſhewed that it was true with regard to any plane triangle whatever. Before the time of Euclid, the Conic Sections had been invented by Menechmus; but it was not till about a hundred and eighty-four years before Chriſt that they were perfected by Appollonius Pergæus. After forty years the great Hipparchus flouriſhed, and to him Aſtronomy is more indebted than to any of the ancients; for he invented ſpherical trigonometry, and made the firſt catalogue of the fixed ſtars. Plato had not only improved geometry, but was the firſt who applied it to phyſics, and thus laid the foundation of a ſolid philoſophy. In this, however, the ancients generally failed. They reaſoned as accurately indeed as the moderns, but inſtead of founding their reaſonings on facts, they built them on hypotheſis and metaphyſics. The conſequence of this was, that, every philoſopher who roſe to ſuperior eminence, overturned the ſyſtem of his predeceſſor, and erected one of his own, which, in its turn, ſhared the fate of thoſe which had been erected on a like ſandy foundation.

PYTHAGORAS, who lived about two hundred and ſixty years before Plato, is ſaid to have underſtood the true ſyſtem of the univerſe. This is perhaps doing too much honour to that great man. For it is not the naked idea of a ſyſtem, but the developement of its elements, which gives a title to the honour of inventing it. Indeed, in my opinion, the great Archimedes, who, it may here be obſerved, is the parent of all that was known to the ancients in the ſciences of Optics and Mechanics, from the manner of his treating arithmetical and geometrical progreſſions, would have as good a right to the glory of the invention of the Logarithms, as Pythagoras has to what is attributed to him reſpecting the true ſyſtem of the world.

IV. From the time of Diophantus of Alexandria, the inventor of Algebra, till that of Copernicus and Galileo, a ſpace of eleven hundred years, the hiſtory of the ſciences preſents us with an almoſt uninterrupted blank. The eyes of the human mind, during that long and gloomy night, ſeem to have been ſealed up in the moſt profound ſleep. The Roman empire, cruſhed under its own weight, buried in its ruins the ſciences and the arts—thoſe monuments which the genius of man had been rearing to the glory of human nature for more than a thouſand years. Upon thoſe ruins, a ſpiritual tyrant erected his throne, and, with the moſt impious domination, enſlaved the free, the heaven-born ſoul of man. Burdened and debaſed by ſuperſtition and prejudice, that being, on whom the Parent of Truth had ſtamped his own image, wandered in the wildeſt labyrinths of error. The philoſophers of this period, if it be not profanation to call them by that name, employed themſelves in meditating and diſputing on words of which neither they nor others ever underſtood the meaning, in fruitleſs reſearches after the philoſophers' ſtone, and in vain predictions of future events from the aſpects of the heavenly bodies. The few individuals who cultivated the powers of their own mind, and directed them to purſuits worthy of a rational being, were only like the ſtars of the night, twinkling through the temporary opening of a thick dark cloud which they could not diſpel.

V. The active genius of man, however, was not to be held in everlaſting chains. A ſpirit of enterpriſe was at length rouſed by ſuperſtition itſelf. * This ſpirit was afterwards greatly ſtrengthened and extended, by the ſucceſsful expedition of Vaſquez de Gama round the Cape of Good Hope, and by the fortunate diſcovery of this vaſt continent by Chriſtopher Colombo.

In the mean time, the ſciences and the fine arts were raiſed from their graves by the Italians, the deſcendants of thoſe very barbarians by whom they had been buried. And commerce,

---

* In the Cruſades againſt the Infidels.

commerce, literature and the imitative arts diffuſed a gleam of light and civil liberty and happineſs over the weſtern part of the old world.

In the ſixteenth century, the works of the ancient philoſophers, particularly thoſe on mathematics and aſtronomy, which had been preſerved by the Arabs, * were brought to Italy and tranſlated. The art of printing, the invention of the preceding century, opened the eyes of the European nations; and they began to ſhake off the ſhackles with which they had been held in bondage for ſo long a ſeries of ages.

VI. Copernicus, a native of Thorn in Pruſſia, ſuperior to the deep rooted

---

* The Arabs, in their treaties with the Emperors of Conſtantinople, were wont to ſtipulate for copies of the works of the ancients.

rooted prejudices of his time and of his ſenſes, was the perſonage to whom the world is indebted for pointing out, in a diſtinct and particular manner, the true ſyſtem of the univerſe. His book on the Celeſtial Revolutions was not publiſhed till after his death, which happened in the year one thouſand five hundred and forty-three. It was with the utmoſt difficulty, and not till he lay on his death-bed, that his friends obtained his conſent to its publication; for he knew too well what treatment he muſt have met with, from the arrogant ignorance and bigotry of his contemporaries.

Galileo, who was born at Piſa in Italy, ſoon after demonſtrated what Copernicus had deſcribed. For this heinous crime he was cited to appear before the Inquiſition at Rome, and that abominable tribunal obliged him to renounce the genuine offspring of his reaſon, and impoſed upon him, when they ſet him at liberty, the pennance of repeating at ſtated times, and for a ſeries of years, the ſeven penitential pſalms.

Here it would be unpardonable to paſs over in ſilence the name of Sir Francis Bacon, Lord Verulam, whoſe ſagacity pointed out the path of ſcience, in which Galileo advanced with a ſecure and rapid pace. I do not think, however, that the name of Bacon, in the liſt of great men, ſhould precede that of Galileo. For although the former ſeemed to ſketch out the plan of the edifice of ſcience, it was the latter who, by his ſuperior knowledge in geometry, was enabled to put that plan in execution.

The firſt teleſcope was accidentally

invented by a ſpectacle-maker in Holland. As ſoon as the news of this invention reached Galileo, he ſet himſelf to work, and, in a ſhort time, completed one much ſuperior; and had the honor of being the firſt who applied it to the purpoſes of Aſtronomy. The diſcoveries which by means of this improvement he was enabled to make, ſurpriſed and delighted his contemporaries. In conſequence hereof the aſtronomical dreams of Ariſtotle and Ptolomey evaniſhed, and the truth of the Copernican ſyſtem was eſtabliſhed on the firmeſt foundation.

Experiment and obſervation, and the geometrical ſpirit which Galileo introduced into natural philoſophy, are the ſame which, at this day, accompany the reſearches into truths of every kind. And the laws of the fall of heavy bodies, which he diſcovered and demonſtrated, are the fruitful ſource of all the improvements that have ſince been made in ſtatics and mechanics.

Under ſo great a maſter, Cavalieri, Torricelli and Viviani made admirable progreſs. The firſt, without knowing it, prepared the calculus of infiniteſimal quantities; the ſecond, by his diſcovery of the barometer, added another branch to ſcience—that of the air; and the laſt, with the Academia del Cimento at Florence, reduced experimental philoſophy to ſyſtem. *

About the ſame time appeared Des Cartes, who, by promoting the ſcience of Algebra, and chiefly by applying algebra to geometry, has merited

---

* Friſi, Elogio del Galileo.

merited the title of a great philoſopher—an appellation which will be continued to him by grateful poſterity, notwithſtanding his falſe and exploded dreams reſpecting the ſyſtem of the world.

VII. The moſt ſimple of the laws of Nature—that of repoſe or equilibrium, has been known for many ages. But the laws of Motion, which are the foundation of natural philoſophy, were unknown to the ancients. How could they know them? Miſtaking quibble for reaſon, and metaphyſics for ſcience, one party of them involved their ſpeculations on motion, in ſophiſtry, and the other denied its exiſtence. Des Cartes ſought for its laws in vain. At length, however, as if time had brought the affair to maturity, the laws of motion appeared at once from all parts of Europe.

They were all diſcovered at the ſame time by Huygens, Wallis and Wren.*

Huygens, by applying the pendulum to time-pieces, of which however he owed the firſt hint to Galileo, and, by diſcovering the theory of centrifugal forces, promoted, in an eminent degree, the advancement of the ſciences. And Kepler, a man of the moſt penetrating genius, by means of the aſtronomical obſervations made by Tycho Brahe, his inſtructor, happily diſcovered the form of the orbits, and the law of the revolutions of the planets.

VIII. Such was the ſtate of ſcience, when Iſaac Newton, a man without an equal in the hiſtory of human genius, appeared to the aſtoniſhed world.

---

* Maupertuis, Oeuvres.

From the mutual gravitation of matter, and from the laws of that gravitation, of which the glory of the diſcovery and demonſtration is entirely his own, he calculated the quantity of matter and the denſity of the ſun and of ſeveral of the planets. He explained, upon the ſame principles, the laws of the planetary ſyſtem which Kepler had found out. He ſhewed alſo that the comets differed eſſentially from the planets in nothing but the excentricity of their orbits, and he was the firſt who attempted to compute the times of their periodical revolutions.* From the ſame principle of gravity he accounted for the ebbing and flowing of the ſea.

---

* The ancients, and the moderns too until Sir Iſaac Newton's time, generally believed the comets to be meteors ſent by the Almighty to portend ſome ſad diſaſter. Seneca the philoſopher, with a ſagacity greatly to his honor, predicted that the time would come in which mankind would entertain juſter notions on the ſubject. *Veniet tempus*, ſays he, *in quo poſteri noſtri, nos tam aperta ignoraſſe, mirabuntur.*

Optics were likewiſe amazingly improved by him. For before his time the moſt remarkable properties of light and colours were entirely unknown.

What enabled this great man to unravel the myſteries of nature with ſuch wonderful ſucceſs, was his ſkill in the mathematics, the bounds of which he extended beyond all expectation. Indeed, if we conſider the ingenuity, the ſimplicity and the extent of the calculus of fluxions, we may affirm that he did more for the advancement of pure mathematics, than all that had gone before him.

Rejecting hypotheſes and metaphyſical viſions, this prince of philoſophers eſtabliſhed the ſcience of nature on the eternal foundation of facts or experiment, and by means of his own mathematics, reared a wonderful and immovable ſuperſtructure, which he carried ſo near to perfection, that little ſeems left to be done by poſterity. A ſeries of above ſixty years, in the moſt enlightened period of the world, has produced little more than a ſuperior degree of poliſh and ſtrength to the fabric.

Perhaps no man was ever more praiſed than Sir Iſaac Newton; and perhaps no man ever deſerved ſo much to be praiſed. * For, to the moſt

---

* He was the idol of his nation while he lived. He will be their boaſt for-ever. All the poets of any note, who have written ſince his time, have celebrated his praiſe. Pope ſays of him,

> *Nature and nature's laws lay hid in night,*
> God *ſaid*, Let Newton be! *and all was light.*

And Voltaire, addreſſing the angels in a poem prefixed to moſt penetrating ſagacity, the moſt exalted genius, and the moſt unwearied patience, he joined the higheſt degree of modeſty, temperance and uprightneſs. He loved ſcience for its own ſake, and becauſe it conducted him to the Supreme Cauſe of All. And ſo far was he from courting fame, that when the invention of the Fluxionary Calculus, the moſt luminous that had ever been made in mathematics, was claimed by Leibnitz, a man inferior to Newton alone, he left his cauſe to itſelf, and thereby ſhewed that he was even ſuperior to the glory of ſo great a diſcovery. †

In

---

to Madame de Chaſtelet's explanation of Newton's Principia, has theſe verſes,

> *Conſidens du Tres-Haut, Subſtances eternelles,*
> *Qui parez de vos feux, qui couvrez de vos ailes ;*
> *Le trône où votre Maître eſt aſſis parmi vous !*
> *Parlez !—Du grand Newton n'etiez vous point jaloux ?*

† The Royal Society of London however ſelected judges from different nations on purpoſe to enquire into the affair. Thoſe judges decided in Newton's favor, and Europe acquieſced in the deciſion.

In contemplating this ſingular character, the ſoul of man, while it feels dignified and tranſported, congratulates itſelf that ſo great an ornament to humanity has exiſted. *

Since

---

* He was interred in Weſtminſter Abbey, and a noble monument was erected to his memory in the moſt conſpicuous part of that church, upon which is the following inſcription :

H. S. E.
Isaacus Newton eques auratus
qui animi vi prope divina
planetarum motus figuras
cometarum semitas oceanique aestus
sua mathesi facem præferente
primus demonstravit
radiorum lucis dissimilitudines
colorumque inde nascentium proprietates
quas nemo ante suspicatus erat
pervestigavit
naturæ antiquitatis sacræ scripturæ
sedulus sagax fidus interpres
Dei O. M. majestatem philosophia aperuit
evangelii simplicitatem moribus expressit
sibi gratulentur mortales
tale tantumque extitisse
humani generis decus.
Nat. xxvi. Dec. A. D. mdcxlii. obiit Mart. xx. mdccxxvi.

SINCE the death of Sir Iſaac Newton, the different branches of the pure mathematics, particularly the inverſe method of fluxions, which opens a boundleſs field for inveſtigation, have been very much improved. Of this improvement, the greateſt ſhare of the praiſe is due to Euler, D' Alembert and De la Grange. Euler was a native of Switzerland, which has produced ſeveral mathematicians of the firſt note. D' Alembert was born in France, where the mathematics are a more faſhionable ſtudy than in any other country. And De la Grange is an honor to Italy, ~~that part of the earth~~ which, from its having been the ſcene of the nobleſt actions, and the miſtreſs of Europe in the arts and ſciences and in civilization, is, in the eyes of a philoſopher,

pher, the moſt intereſting ſpot on the ſurface of the globe. *

I SHALL conclude this part of my ſubject by obſerving that the phyſical part of Aſtronomy has within theſe few years been advanced far beyond our hopes by the aſtoniſhing improvement of the teleſcope in the hands of William Herſchel, a native of Heſſe in Germany. †

HAVING given a brief account of the origin, progreſs and chief promoters of the mathematical ſciences; I come now to ſpeak of their importance,

---

* Had it been conſiſtent with the author's plan, he might have mentioned the ſhare which Regiomontanus, Fermat, Wallis, James Gregory, John and Daniel Bernoulli, the Marquis de L'Hôpital, Bradley, Clairaut, De la Caille, Maclaurin, and ſome others, have had in the progreſs of the ſciences.

† This gentleman receives a liberal penſion from the king of Great-Britain, and the Univerſity of Edinburgh have done themſelves the honor to make him a Doctor of Laws.

tance, and of the advantages derived from them.

I. The mathematical ſciences, independently of their application to any particular purpoſe, are of the utmoſt conſequence to the ſtudent.

The terms made uſe of in the mathematics are clearly and exactly defined. None but ſelf-evident truths are admitted as firſt principles. From a ſingle known principle we deduce, by the moſt ſolid ratiocination, a thouſand unknown truths, which, in their turn, become principles, and ſerve as the foundation of an infinite number of others. On this account there is no occupation ſo well adapted as the ſtudy of this ſcience, to brighten and enlarge that reaſoning power which forms the moſt diſtinguiſhing feature of man. For thoſe who are accuſtomed to the moſt clear and undeniable principles, and to the moſt accurate demonſtrations, muſt neceſſarily be the beſt judges of reaſoning of every kind.

So neceſſary, in the eſtimation of the philoſophers of antiquity, was the knowledge of geometry to the ſucceſsful proſecution of other branches of ſcience, that they inſcribed over the doors of their academies, *None who is ignorant of geometry is permitted to enter here.* And we are told by Dionyſius of Halicarnaſſus, that Xenocrates ſaid to a young man unacquainted with this ſcience, who deſired to be admitted to the ſtudy of philoſophy, *Apage! apage! anſas philoſophiæ non habes.*

But the mathematics tend to form the morals, as well as to improve the intellectual faculties of youth. One of the great principles of the corruption of all mankind, is the ſtrong propenſity and attachment they feel to the objects of ſenſe. Now the ſtudy of the mathematics being an occupation purely intellectual, if the minds of young people can be brought to be captivated with it, they will proportionably loſe their attachment to ſenſual pleaſures, and learn to reliſh enjoyments of a nature infinitely more refined. It inſpires us with a ſenſe of order, of regularity and of dignity. And it is well known how powerful an influence a juſt ſenſe of theſe has on our moral conduct. It enables us to bridle the ſallies of imagination, to moderate our paſſions and our temper, and to eſtimate things according to their intrinſic value. And by teaching us the ſcantineſs of human knowledge, it humbleth our pride, and diſpoſeth us to ſuffer our neighbour to enjoy his opinions in peace, particularly in things not ſuſceptible of demonſtration, or not warranted by indubitable teſtimony. Here truth appears like the ſun in a cloudleſs ſky, whereas in many other parts of human learning it is enveloped in miſt and obſcurity. Every mind capable of attention muſt therefore be pleaſed with the mathematics; for, corrupted and degenerated as we are, we ſtill poſſeſs an ardent love of truth.

Now this detachment from ſenſible objects, and the cultivation of the love of truth, are very conſiderable ſteps towards virtue. And I agree moſt cordially with a celebrated writer * when he ſays, "I ſhould not think the moſt exalted faculties of the hu-

---

* Junius.

man mind a gift worthy of the Divinity, nor any aſſiſtance in the improvement of them a ſubject of gratitude to my fellow-creature, if I were not ſatisfied that really to inform the underſtanding, corrects and enlarges the heart."

It is ſaid by ſome that this ſcience tendeth to make men ſceptics in every thing which is not ſuſceptible of mathematical demonſtration, and therefore, that, inſtead of being uſeful, it is, in the higheſt degree, dangerous to the intereſts of morality and religion. This is a heavy charge indeed: but fortunately it is not founded on fact or on the nature of things. There have been none diſtinguiſhed for their mathematical knowledge, who were not alſo remarkable for the purity of their morals, and the inoffenſiveneſs of their deportment.

portment. Napier, Paſcal and Newton, than whom their reſpective countries never produced greater geniuſes for the mathematics, were all eminent for their uprightneſs, their piety, and their zeal for the chriſtian religion.

It is the property of errors to claſh with one another; but truth, which is ſimple and eternal like its Author, can never be oppoſed to itſelf. Mathematical truth, therefore, is perfectly conſiſtent with every other ſpecies of truth. Is there no demonſtration but what is mathematical? Do not mathematicians as well as others feel within themſelves, are they not from what they ſee around them, irreſiſtibly forced to confeſs the exiſtence and attributes of the Deity? From this firſt principle do we not deduce, by the moſt accurate reaſoning, that this Being ought to be loved and worſhipped, and likewiſe infer a thouſand other conſequences, of the truth of which the mind is as firmly convinced, as of the truth of any mathematical propoſition whatever? This firſt principle of morality has indeed been denied by a few individuals: the truth of the firſt principles of the mathematics, has alſo been queſtioned. But ſuch as quibble in matters ſo ſelf-evident and ſo important, deſerve to be pitied, not anſwered.

INSTEAD of theſe ſciences being hurtful to religion and morality, they will be found to be of the greateſt advantage to them. Natural philoſophy in particular, by leading us in a ſatisfactory manner, to the knowledge of one almighty, all-wiſe and all-good Being, who created, preſerves and governs the univerſe, is the very hand-maid of religion. Indeed I conſider a ſtudent of that branch of ſcience as engaged in a continued act of devotion. And were it poſſible that ſuch a perſon ſhould be wanting in reverence to the author of all, he would deſerve to be ranked with thoſe whoſe underſtanding God hath taken away. * This immenſe, beautiful and varied univerſe, is a book written by the finger of Omnipotence, and raiſes the admiration of every attentive beholder. But it is written in the language of geometry, without the knowledge of which, the excellencies of the workmanſhip, and the ſkill of the great Artiſt, can be but imperfectly underſtood. †

II. SINCE the ſubjects of mathematical enquiry are ſpaces, times, velocities,

---

* *An undevout Aſtronomer is mad.* YOUNG.

† Galileo, Saggiatore.

velocities, weights, meaſures, in ſhort every thing ſuſceptible of augmentation and diminution, theſe ſciences are ſo intimately connected with all the arts of procuring the neceſſaries, conveniencies and comforts of life, that the cultivation of them is of the higheſt importance.

It is by them that we are enabled to determine with accuracy, the length of the year, and its diſtribution into ſeaſons: that we have invented and improved to a ſurprizing degree, the machines for the equable meaſurement of time: that we calculate the riſing and ſetting and eclipſes of the ſun and moon and other heavenly bodies: that we have found out the true figure and dimenſions of the earth: that we conduct with certainty and ſafety, veſſels over the pathleſs ocean: that we conſtruct machines which ſave an amazing expenſe of labor and time: that we aſſiſt enfeebled viſion, and wonderfully improve the moſt perfect: that we make peaceful diviſions of landed property: that we improve the means of ſelf-defence, and of carrying on war: that we build commodious and ſtately habitations: that we digeſt the events of hiſtory in their proper order: that we perfect the inſtruments of muſic, and ſubject muſic to its proper laws.

I COULD mention a great many more purpoſes to which theſe ſciences are applicable, but the above enumeration is ſufficient to convince every one of their vaſt extent and utility. But here an objection preſents itſelf. What neceſſity is there for ſo much mathematics, ſo much ſcience? May not almoſt all the purpoſes you have mentioned, be accompliſhed without ſo much mathematics? If we have mathematics enough to be able to meaſure our fields, and to do other neceſſary things, is not that ſufficient? Even Socrates, whoſe name ſhould not be pronounced but with veneration, was wont to talk in this ſtrain. What a happy thing would it be, however, if all the objections to truth could be as eaſily anſwered as this!

In the firſt place Socrates was not a proper judge in this matter, for he was not a mathematician. If he had been one, he would have ranked the ſtudy of this ſcience among the neceſſaries of life. For ſo ſtrong is the attachment to it, that thoſe who have made progreſs in it, feel, that there is not a ſingle inſtance in which that attachment has been entirely diſſolved, and very few inſtances in which it has been even weakened to any conſiderable degree. And were Socrates now alive, and informed that the moſt ſubtile parts of the mathematics, as well as the niceſt aſtronomical obſervations, are neceſſary for preparing the tables for calculating the longitude at ſea, and that thereby the lives of many of his fellow-creatures are preſerved, he would not ſay that "no more geometry is neceſſary than may enable us to meaſure our fields."

With regard to the cultivation of the mathematics beyond the viſible purpoſes of applying them, we have one very remarkable inſtance which will not be denied to be a very good apology for doing it. The ancient geometers perfected the curves called Conic Sections, without knowing that the planets revolved round the ſun in one of thoſe curves. Why, therefore, may not we purſue this ſtudy, as far as the intellect which our heavenly Father hath given us will permit, and by this mean add ſome more ſteps to a ladder on which poſterity may mount to a height which at preſent ſurpaſſes our conception.

THERE have been ſome individuals, of a very different ſtamp from Socrates, who endeavoured to degrade the mathematics in the eſtimation of the world. The chief of theſe are Ariſtippus, Epicurus, the Abbé des Fontaines and Joſeph Scaliger the critic.

IT is no way ſurpriſing that a ſtudy which requires a ſtrong and continued exertion of the mind, ſhould prove an ungrateful taſk to a voluptuous man—and ſuch was Ariſtippus.

Epicurus and his follower Lucretius, who believed that the ſun and moon were no bigger than they appeared to the eye, ſhould have learned at leaſt the elements of geometry, before they preſumed to ſlander it.

The Abbé des Fontaines thought the ſtudy of the mathematics rather beneath the dignity of a man of genius, and he was wont to ſay that to be a great mathematician no more was requiſite than to be very diligent, and to live very long. Now he was certainly miſtaken. For Clavius, Wolfius and Renaldini, although among the moſt voluminous, are far from being among the moſt eſteemed of that profeſſion; and Leibnitz, Des Cartes and Newton were young when they made their greateſt diſcoveries. Indeed it is a general fact that the greateſt mathematicians have ſhewn themſelves to be ſuch, in their youth. But we need not wonder that this Abbé, with whom exactneſs and equity are ſaid * to have been virtues purely ſpeculative, ſhould endeavour to traduce a ſcience of which he was as ignorant as his brethren juſt mentioned.

As to Joſeph Scaliger it is obſervable that it was not until after an unſucceſsful attempt to ſolve ſome geometrical problems, he became an enemy to geometricians. From this we may infer that one may be a very good critic in the languages, without having a mathematical genius. To be the firſt more memory than judgment is required; to poſſeſs the latter more judgment than memory is neceſſary.

HAVING

---

* Montucla, Hiſtoire des Mathematiques.

Having now finiſhed what I propoſed to ſay on this ſubject, I beg leave to treſpaſs on your patience for a few minutes more, while I addreſs myſelf to the Students and to the Truſtees of the College.

To the Students.

Young Gentlemen, What I have ſaid reſpecting the cultivators and the importance of the mathematical ſciences, I hope will make ſuch an impreſſion on your minds, as will induce you to apply to them with unremitting ardor. The circumſtances and ſituation of this country ſhould ſerve as an additional motive to application. In the European countries the cuſtoms and manners of the people are in a great meaſure ſettled by long and inveterate habit. In this country they are in a very fluctuating ſtate,

ſtate. In the former the influence of particular purſuits in learning is imperceptible, and ſlow in its operation. In the latter it is rapid and very diſcernible. It is therefore of the laſt importance that you ſhould improve your minds to the greateſt advantage; and of all the branches of human ſcience, there is none better adapted to accompliſh this end than what I recommend to you.

Mathematical knowledge is generally ſuppoſed to be acquired with difficulty. I can aſſure you, however, that the difficulty ariſes rather from want of attention than from want of ſagacity in thoſe who make the attempt. With a firm reſolution and a perſevering diligence, you cannot fail of ſucceſs. Without them, the greateſt genius would be of no avail.

It gives me a great deal of pleaſure, Gentlemen, to have occaſion to obſerve, in this public manner, that a conſiderable majority of thoſe of you who have ſtudied the mathematics under my direction, have acquitted themſelves even better than my expectations, which, believe me, were very ſanguine. And I hope this teſtimony of approbation will prove another inducement to your future exertions. I beg that you, gentlemen, who are about to receive the honors of college, and to enter into the world, will by no means imagine that you have yet acquired a ſufficient knowledge of this or of any other ſubject of your ſtudies; for a College Education is intended rather to ſketch out the plan, and to lay the foundation, than to complete the fabric of the liberal arts and ſciences. And I conjure all of you to remember that, whatever be the talents which the Father of mankind has beſtowed upon you, and however much you may improve thoſe talents, it ſhould be the chief and invariable ſtudy of your lives to employ them in doing good to your fellow-creatures; for, of all the curſes that can befal humanity, that of the miſapplication of genius is the greateſt, and the moſt pernicious to the individual and to ſociety.

To the Truſtees.

Mr. Preſident and Gentlemen of the honorable Corporation of Truſtees, It is with the deepeſt ſenſe of gratitude that I return you thanks for your unanimous appointment of me to the Profeſſorſhip of Mathematics and Natural Philoſophy. As I conſider the Duties of my ſtation, and the happineſs of my life to be inſeparably connected, I truſt you are firmly convinced that no exertions on my ſide, ſhall be wanting to juſtify your choice, and to merit your approbation. I feel a very high degree of ſatisfaction in being a member of a Faculty, whoſe names will be for-ever dear to the wellwiſhers to the cauſe of learning and of the liberties of mankind, and in having it in my power to unite with them in giving the tone to the turn of thinking of the future legiſlators of America. It is your province, Gentlemen, to co-operate with us in this important buſineſs, by replacing ſuch parts of the philoſophical apparatus as we were deprived of by the incidents of the war, which was proſecuted by our enemies in the true ſpirit of the Goths and Vandals. *

Addreſs to the Supreme Being.

FATHER of truth and reaſon and of every thing that lives! Be pleaſed to proſper the intereſts of ſcience and literature in the United States of America: to make thoſe intereſts ever ſubſervient to the promotion of liberty, happineſs and virtue: to preſerve this riſing and extenſive empire from the ill-boding ſpirit of conqueſt: to protect this country as a ſecure and happy aſylum to the oppreſſed

---

* The Britiſh ſeemed to have a particular antipathy to our Seminaries of learning, and our Preſbyterian Churches. As to Princeton College, the American ſoldiers had their ſhare in the depredations committed on it.

oppreſſed in all quarters of the globe: to enlighten the inhabitants of the eaſtern hemiſphere in the knowledge of the rights of mankind, and in the arts of government and peace: to cauſe truth and reaſon at length to obtain a glorious and everlaſting victory over error and violence; and to inſtruct all the nations of the world in the way of uprightneſs and felicity. Amen.

BRITISH
26 JY 77
MUSEUM